IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

Appeal Brief

This brief is submitted in support of the Notice of Appeal which was filed on May 1, 2009.

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(i) Real party in interest

The real party in interest in this application is UTC Power Corporation, formerly UTC Fuel Cells, LLC which is the assignee of record.

(ii) Related appeals and interferences

There are no known related appeals and/or interferences.

(iii) Status of Claims

The application contains claims 1, 4-24, 49, 52-53, 55-56 and 58-62, all of which are rejected and on appeal.

Claims 2-3, 25-48, 50-51, 54 and 57 have previously been cancelled.

(iv) Status of Amendments

Only the request for reconsideration filed on April 6, 2009 was filed since the final rejection, and this response did not include any claim amendments. The request for reconsideration was acted upon by the examiner as explained in the advisory action of April 15, 2009, but did not result in allowance of the application.

There are therefore no un-entered claim amendments and the claims are as were listed in the response filed October 3, 2008, and as set forth in the Claims Appendix to follow.

(v) Summary of claimed subject matter

The claims include independent claims 1 and 49, each of which is summarized below.

Claim 1 is drawn to: In a solid oxide fuel cell **(See specification, page 5, lines 22-26 (paragraph [0033])**, an interconnect assembly comprising:

a separator plate **(24, Figure 1, see specification page 7, lines 7-9)**having two opposed surfaces; and

at least one electron conducting compliant interconnect **(30, 32, Figure 1, see specification page 7, lines 7-14)** having a first coefficient of thermal expansion, the compliant interconnect being in electrical communication with the separator plate, the compliant interconnect comprising a compliant superstructure **(Figure 2, see specification page 7, lines 20-24)** having a first portion **(36, Figure 2, see specification page 7, lines 15-19)** defining a separator plate contact zone permanently bonded to said separator plate and a second portion **(34, 38, Figure 2, see specification page 7, lines 7-14)** defining an electrode contact zone permanently bonded to an electrode having a second coefficient of thermal expansion different from said first coefficient of thermal expansion, wherein the superstructure is porous **(See specification page 8, lines 4-8)** to operating fuel cell gaseous materials, and wherein the interconnect comprises a woven substructure **(See specification page 8, lines 4-8)** formed into said superstructure and defining the separator plate contact zone and the electrode contact zone.

Claim 49 calls for a solid oxide fuel cell stack **(See specification page 5, lines 22-26)** comprising:

at least three solid oxide fuel cell assemblies **(12, Figure 1)**, in electrical contact, wherein at least one solid oxide fuel cell assembly comprises an electrode **(18, 20, Figure 1, see specification page 7, lines 4-6)**, a separator plate **(24, Figure 1, see specification page 7, lines 7-9)**, and an electron conducting compliant interconnect **(30, 32, Figure 1, see specification page 7, lines 9-14)** having a first coefficient of thermal expansion, the compliant interconnect being positioned between the electrode and the separator plate, the interconnect comprising a compliant superstructure **(Figure 2, see specification page 7, lines 20-24)** having a first portion **(36, Figure 2, see specification page 7, lines 15-19)** defining a separator plate contact zone permanently bonded to said separator plate and a second portion **(34, 38, Figure 2, see specification page 7, lines 7-14)** defining an electrode contact zone permanently bonded to said electrode, said electrode having a second coefficient of thermal expansion which is different from said first coefficient of thermal expansion, wherein the superstructure is porous to operating fuel cell gaseous materials **(See specification page 8, lines 4-8)**, and wherein the interconnect comprises a woven substructure **(See specification page 8, lines 4-8)** formed into a superstructure defining the separator plate contact zone and the electrode contact zone.

As to the CTE recited in both claims, see the specification at page 5, lines 22-26, and page 6 lines 1-6, for example.

As to the bonding recited in both claims, see specification page 7, lines 4-6, discussing bonding layer

22 on one side of interconnect 30, 32, and Figure 1, and see also the specification at page 10, lines 21-23 as to bonding between separator 24 and interconnects 30, 32.

(vi) Grounds of rejection to be reviewed on appeal

Ground 1 – Whether claims 1, 4, 6, 7, 10, 11, 21, 23, 24, 49, 52, 59 and 60 are obvious under 35 USC 103(a) based upon WO 99/13522 in view of Xue (US 5,702,837.

Ground 2 – Whether claims 1, 4–9, 11–24, 49, 52, 53, 55, 56 and 58–62 are obvious under 35 USC 103(a) based upon Nazmy (US 5,064,734) in view of DE 19517443 in view of Xue.

(vii) Argument

Ground 1 – Whether claims 1, 4, 6, 7, 10, 11, 21, 23, 24, 49, 52, 59 and 60 are obvious under 35 USC 103(a) based upon WO 99/13522 in view of Xue (US 5,702,837.

The present office action contains two grounds of rejection, with Ground 1 being based on WO '522 and Xue, and Ground 2 being based on a combination of Nazmy, DE '443 and Xue.

The primary references in both grounds, that is, WO '522 and Nazmy/DE '443, were stated by the Examiner to lack a teaching of bonding as called for in claims 1 and 49. Responsive to this deficiency, the Examiner has relied upon the teachings of Xue. As set forth below, it is submitted that this rejection is in error and should be reversed.

The teachings of Xue relate to all ceramic SOFC (see for example columns 1 and 2) with relatively well matched materials in terms of thermal expansion coefficients. More particularly, the teachings of Xue relate to the bonding of anode/anode and anode/interconnect pairs, in which the anode part is a ceramic material, i.e., nickel oxide and zirconia in the fabrication (prior to reduction which turns nickel oxide to nickel in an operating SOFC) and the interconnect is also a ceramic material, i.e., strontium-doped lanthanum chromite as cited in column 1, lines 20-21, and column 7, lines 9-13.

In contrast, the pending application teaches bonding of the cathode electrode to a metallic interconnect and an anode electrode to a metallic interconnect.

The teachings of Xue relate to the bonding of ceramic to ceramic and this teaching does not carry over to the bonding of a ceramic electrode to metallic interconnect as

is the case in the pending application, i.e., the pairs of materials are different and it is well known in the art that bonding of a ceramic to a metal is a very challenging undertaking and requires materials that can "couple and react" with the outermost atoms of the metal surface.

The teachings of Xue relate to ceramics which are known to have a rigid structure that is not compliant (i.e., ceramics fracture instead of plastically deforming under stress). In contrast, the interconnect of the pending application is based on metals, i.e., nickel-based alloys, which are formed into compliant structures. As a result, the teachings of Xue are not relevant to the teachings of the pending application and would not be consulted by a person skilled in the art attempting to modify the teachings of either WO '522 or Nazmy/DE '443.

The brittle structure of Xue would dictate against a permanent bond to another structure having a different CTE, and thus a person skilled in the art would both be led away from the invention by the teachings of Xue, and would also have no reasonable expectation of success attempting such a modification since again the brittle nature of the ceramics of Xue would not work well with the bonds of the present claims.

Claims 1 and 49 each require an SOFC structure and permanent bonds between the interconnect and the separator plate on one side and the electrode on the other. The art of record does not teach this combination. Instead, both WO '352 and Nazmy/DE '443 leave these components unbonded, and Xue teaches bonding of very different components which would not at all be expected to be useful in the environment of the present invention or the primary

references. The rejection is in error and should be reversed.

Ground 2 - Whether claims 1, 4-9, 11-24, 49, 52, 53, 55, 56 and 58-62 are obvious under 35 USC 103(a) based upon Nazmy (US 5,064,734) in view of Xue.

This rejection has been dealt with in its entirety above in connection with Ground 1. Specifically, the argument in question is based upon the non-combinability of the Xue secondary reference with Nazmy in view of DE '443. As set forth in Ground 1, Nazmy teaches away from a combination that meets the present claims, and also would not lead a person skilled in the art to have any reasonable belief that the structures of Xue could be combined into the structures of the primary references with any degree of success.

Dependent claim 56 is rejected in this ground, and it is submitted that claim 56 calling for a specific structure of the interconnect is further in condition for allowance. Nothing in the art of record is believed to disclose or suggest this structure. Dependent claim 58 is supported by the same reasoning as dependent claim 56. Thus, both of these claims are believed to be allowable due to their dependency from claims 1 and 49 respectively, and also in their own right. Reversal of the rejections of these claims is earnestly solicited.

Based upon the above, nothing in the art of record discloses or suggests the specific structures of claim 1 and 49, and especially not the permanently bonded interconnect set forth therein. The rejections of claims 1

and 49 are therefore in error and should be reversed. Each of the dependent claims depending upon claims 1 and 49 is allowable based upon dependency from claims 1 and 49 respectively, and rejection of these claims should also be reversed.

This paper is accompanied by authorization to charge a fee for filing an appeal brief and also for an extension of time. It is believed that no other fee is due in connection with this paper. If, however, any such fee is due, please charge same to Deposit Account 02-0184.

Respectfully submitted,

By__/george a. coury/__
George A. Coury
Reg. No. 34,309
Attorney for the Applicant
Tel 203-777-6628, x113
Fax 203-865-0297
October 1, 2009 E-mail: docket@bachlap.com

(viii) Claims appendix

1. (Previously presented, rejected and on appeal) In a solid oxide fuel cell, an interconnect assembly comprising:

a separator plate having two opposed surfaces; and

at least one electron conducting compliant interconnect having a first coefficient of thermal expansion, the compliant interconnect being in electrical communication with the separator plate, the compliant interconnect comprising a compliant superstructure having a first portion defining a separator plate contact zone permanently bonded to said separator plate and a second portion defining an electrode contact zone permanently bonded to an electrode having a second coefficient of thermal expansion different from said first coefficient of thermal expansion, wherein the superstructure is porous to operating fuel cell gaseous materials, and wherein the interconnect comprises a woven substructure formed into said superstructure and defining the separator plate contact zone and the electrode contact zone.

2. (Canceled).

3. (Canceled).

4. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein said superstructure comprises a first plurality of substructures disposed in a first direction and a second plurality of substructures disposed

in a second direction different from said first direction so as to define a woven structure.

5. (Previously presented, rejected and on appeal) The assembly of claim 4 wherein at least one substructure is pre-buckled.

6. (Previously presented, rejected and on appeal) The assembly of claim 4 wherein said substructures comprise wires, and wherein said woven structure is a wire weave.

7. (Previously presented, rejected and on appeal) The assembly of claim 4 wherein said substructures comprise pre-buckled wires, and wherein said woven structure is a wire weave.

8. (Previously presented, rejected and on appeal) The assembly of claim 4 wherein said superstructure is dimpled, and wherein further a first plurality of dimples define said separator plate contact zone and a second plurality of dimples define said electrode contact zone.

9. (Original, rejected and on appeal) The assembly of claim 8 wherein said first plurality of dimples extend substantially opposite to said second plurality of dimples.

10. (Original, rejected and on appeal) The assembly of claim 1 wherein said interconnect is a cathode-side interconnect.

11. (Original, rejected and on appeal) The assembly of claim 1 wherein said interconnect is an anode-side interconnect.

12. (Original, rejected and on appeal) The assembly of claim 1, wherein said superstructure has a compliance of at least about 5 X 10^{-6} mm^2/N.

13. (Original, rejected and on appeal) The assembly of claim 1, wherein said superstructure has a compliance of at least about 5 X 10^{-5} mm^2/N.

14. (Original, rejected and on appeal) The assembly of claim 1, wherein said superstructure has a compliance of at least about 5 X 10^{-4} mm^2/N.

15. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein said superstructure is shaped to include at least one substantially orthogonal channel.

16. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein said superstructure is shaped to include at least one substantially slanted channel.

17. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein said superstructure is shaped to include at least one substantially square channel.

18. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein said superstructure is

shaped to include at least one substantially rectangular channel.

19. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein said superstructure is shaped to include at least one substantially sinusoidal channel.

20. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein said superstructure is shaped to include at least one substantially hour-glass shaped channel.

21. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein said superstructure is comprised of a stainless steel, stainless steel alloy, or nickel-based super-alloy.

22. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein said superstructure is comprised of a nickel-chromium-based alloy.

23. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein said superstructure is comprised of a noble metal-coated alloy.

24. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein said superstructure is comprised of a composite of at least two materials.

25-48. (Canceled).

49. (Previously presented, rejected and on appeal) A solid oxide fuel cell stack comprising:

at least three solid oxide fuel cell assemblies in electrical contact, wherein at least one solid oxide fuel cell assembly comprises an electrode, a separator plate, and an electron conducting compliant interconnect having a first coefficient of thermal expansion, the compliant interconnect being positioned between the electrode and the separator plate, the interconnect comprising a compliant superstructure having a first portion defining a separator plate contact zone permanently bonded to said separator plate and a second portion defining an electrode contact zone permanently bonded to said electrode, said electrode having a second coefficient of thermal expansion which is different from said first coefficient of thermal expansion, wherein the superstructure is porous to operating fuel cell gaseous materials, and wherein the interconnect comprises a woven substructure formed into a superstructure defining the separator plate contact zone and the electrode contact zone.

50. (Canceled).

51. (Canceled).

52. (Previously presented, rejected and on appeal) The apparatus of claim 49, wherein said superstructure comprises a first plurality of substructures disposed in a first direction and a second plurality of substructures disposed in a second direction different from said first direction so as to define a woven structure.

53. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein the superstructure has a substantially sinusoidal cross section along at least two different lines in a plane of the superstructure.

54. (Cancelled)

55. (Previously presented, rejected and on appeal) The apparatus of claim 49, wherein the superstructure has a substantially sinusoidal cross section along at least two different lines in a plane of the superstructure.

56. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein the interconnect further comprises connecting portions between the first contact surfaces and the second contact surfaces, wherein the connecting portions extend away from the first contact surfaces toward the second contact surfaces, and wherein the connecting portions converge as they extend away from the first contact surfaces.

57. (Cancelled)

58. (Previously presented, rejected and on appeal) The apparatus of claim 49, wherein the interconnect further comprises connecting portions between the first contact surfaces and the second contact surfaces, wherein the connecting portions extend away from the first contact surfaces toward the second contact surfaces, and wherein

the connecting portions converge as they extend away from the first contact surfaces.

59 (previously presented, rejected and on appeal) The assembly of claim 1, wherein the electrode is a ceramic electrode.

60. (previously presented, rejected and on appeal) The apparatus of claim 49, wherein the electrode is a ceramic electrode.

61. (Previously presented, rejected and on appeal) The assembly of claim 1, wherein the interconnect is defined by wires in a woven structure defining said separator plate contact zone and said electrode contact zone, wherein said wires have a thickness and wherein said separator plate contact zone and said electrode contact zone are spaced from each other a distance which is greater than said thickness of said wires.

62. (Previously presented, rejected and on appeal) The assembly of claim 49, wherein the interconnect is defined by wires in a woven structure defining said separator plate contact zone and said electrode contact zone, wherein said wires have a thickness and wherein said separator plate contact zone and said electrode contact zone are spaced from each other a distance which is greater than said thickness of said wires.

(ix) Evidence appendix – None

(x) Related proceedings appendix – None